

NASA TECH BRIEF

Lewis Research Center



NASA Tech Briefs announce new technology derived from the U.S. space program. They are issued to encourage commercial application. Tech Briefs are available on a subscription basis from the National Technical Information Service, Springfield, Virginia 22151. Requests for individual copies or questions relating to the Tech Brief program may be directed to the Technology Utilization Office, NASA, Code KT, Washington, D.C. 20546.

Low-Void Polyimide Resins for Autoclave Processing

Continuing research on a series of thermally stable addition (A)-type polyimide polymers has produced a polyimide resin suitable for autoclave processing, which can be used to produce low-void composite materials.

Fiber reinforced plastic composite materials with high level mechanical properties and high temperature serviceability are destined for many aerospace and other industrial applications. The size and configuration of such proposed structures require that the composites be molded by an autoclave process.

In NASA Tech Brief 69-10118, a method was described for synthesizing thermally stable polyimide prepolymers which cured without the release of volatile material. Based on this work, an advanced A-type polyimide has recently been developed which can be used to produce autoclave molded, low-void content composites suitable for use at temperatures up to 316°C. Glass fiber and high modulus graphite fiber reinforced laminates (flat panels) have been successfully fabricated in an autoclave process.

The autoclavable A-type polyimide formulation, called P10P-A, consists of a mixture of Methyl Nadic Anhydride, an 80:20 molar ratio of methylene dianiline and thiodianiline, and pyromellitic dianhydride at a formulated molecular weight of 1000. Glass reinforced autoclave composites containing P10P-A have flexure strengths of over 5.5×10^8 N/m² (80,000 psi) at room temperature with 75% retention at 316°C. Interlaminar shear strength retention at 316°C is greater than 60% and modulus retention is greater than 85%.

To establish the utility of the new P10P-A formulation, a demonstration structural component consisting of T-sections and curved sections was autoclaved. The

demonstration component had a low void content and maintained mold dimensions within 0.2 mm.

Notes:

1. The low-void polyimide resin material and autoclaving process appear to have many useful applications. While aimed primarily at making autoclaving of A-type polyimide resins possible, the new P10P-A polyimide prepolymer can also be fabricated into reinforced and unreinforced structures by press molding or laminating techniques.
2. The following NASA Tech Briefs describe other Lewis Research Center-sponsored work on polyimide polymers:

Tech Brief 69-10118
Tech Brief 70-10300
Tech Brief 70-10330
Tech Brief 70-10504
Tech Brief 71-10442
Tech Brief 72-10175

3. The following documentation may be obtained from:
National Technical Information Service
Springfield, Virginia 22151
Single document price \$3.00
(or microfiche \$0.95)

Reference: NASA CR-72984 (N72-18584),
Thermally Stable Laminating Resins

4. Technical questions may be directed to:
Technology Utilization Officer
Lewis Research Center
21000 Brookpark Road
Cleveland, Ohio 44135
Reference: B72-10728

(continued overleaf)

Patent status:

Inquiries concerning rights for the commercial use of
this invention should be addressed to:

Patent Counsel
Lewis Research Center
Mail Stop 500-311
21000 Brookpark Road
Cleveland, Ohio 44135

Source: R. J. Jones and R. W. Vaughan of
TRW Systems
under contract to
Lewis Research Center
(LEW-11665)